

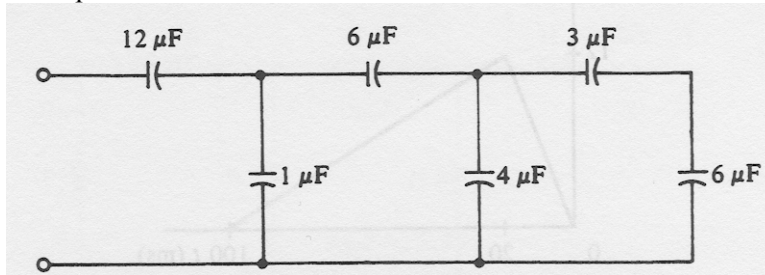
**Homework Assignment #5**

Due at 11 AM in 240 Cory on Friday, 10/10/03

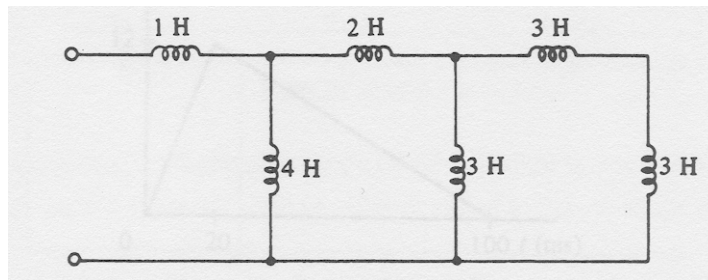
\* Be sure to put your name and **Discussion Section number** on your paper; **otherwise 5 pts will deducted from your score!**

**Problem 1: Energy Storage Elements**

- a) A  $10 \mu\text{F}$  capacitor is charged to 20 V. Find the charge and energy stored.
- b) Find the equivalent capacitance:

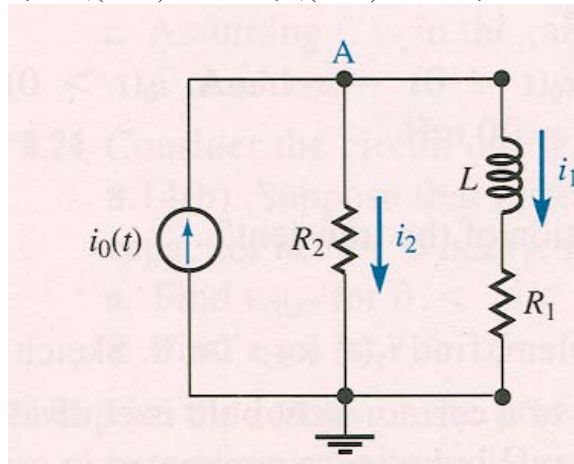


- c) A 5 mH inductor has a current of 200 mA. Find the flux linkage  $\lambda = Li$  and the energy stored.
- d) Find the equivalent inductance:



**Problem 2: Transient Response of RL Circuit**

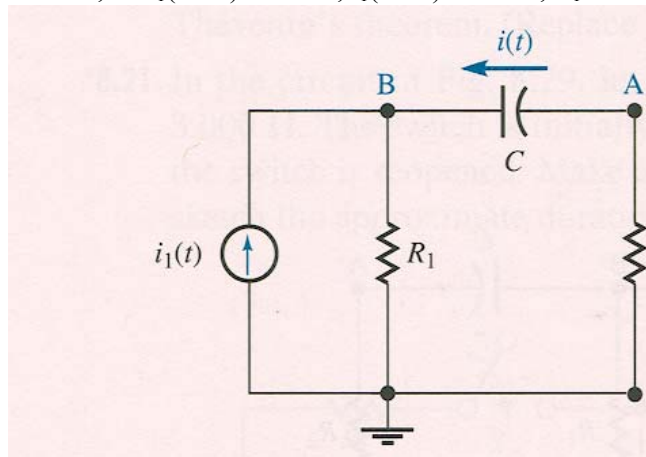
For the circuit shown below, let  $i_0(t < 0) = -1 \text{ mA}$ ,  $i_0(t > 0) = 2 \text{ mA}$ ,  $R_1 = 2 \text{ k}\Omega$ ,  $R_2 = 3 \text{ k}\Omega$ , and  $L = 20 \text{ mH}$ .



- a) Find  $v_A(t)$  for  $t > 0$ .
- b) What is the approximate duration of the transient?
- c) Sketch  $v_A(t)$ .

**Problem 3: Transient Response of RC Circuit**

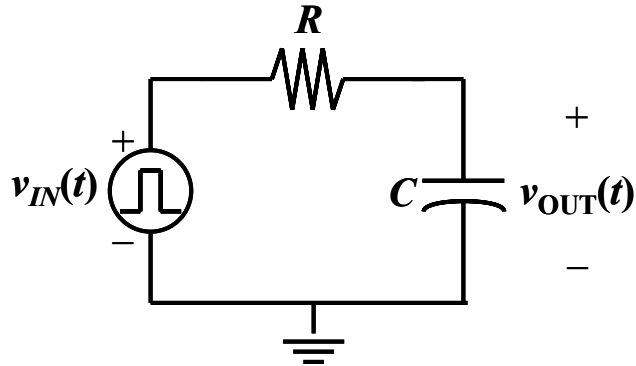
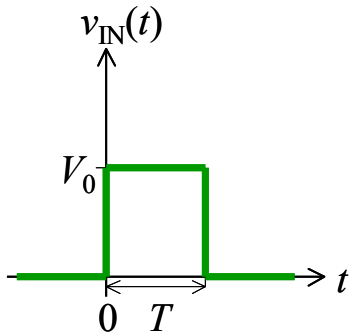
For the circuit shown below, let  $i_1(t < 0) = 4 \text{ mA}$ ,  $i_1(t > 0) = 0 \text{ mA}$ ,  $R_1 = 500 \Omega$ ,  $R_2 = 1.5 \text{ k}\Omega$ , and  $C = 1 \mu\text{F}$ .



- Find  $v_A(t)$  for  $t > 0$ .
- What is the approximate duration of the transient?
- Sketch  $v_A(t)$ .

**Problem 4: Sequential Switching**

Consider the circuit shown below on the right, with the rectangular input voltage pulse shown below on the left. Suppose that the voltage across the capacitor at  $t = 0$  is  $xV_0$ , where  $x$  is a constant.



- Find  $v_{OUT}$  for  $0 < t < T$ .
- Find  $v_{OUT}$  for  $t > T$ .
- Use your results in (a) and (b) to analyze the case when the input consists of an infinite sequence of pulses separated by  $T$  (in other words, a rectangular wave). Note that in this case  $v_{OUT}(t = 2T)$  must be equal to  $xV_0$ . Find the minimum and maximum values of  $v_{OUT}(t)$ , and sketch  $v_{OUT}(t)$  as a function of time.